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Assessing User Satisfaction of Current Enterprise Systems and Their Adaptability From the Perspective of Top Management

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ABSTRACT Due to the dynamic nature of the business environment, organisations regularly face rapid changes for which they need to adapt their Enterprise Systems (ESs). This makes ES adaptability essential. We identify ES adaptability as a conceptual notion that bridges the strategic and the technical domains. We provide a conceptual and empirical analysis that captures the current state of ESs from a top management perspective and shows the challenges of and potential for ES adaptability. Results show that having an adaptable ES is critical for an organisation to manage uncertainties and continue providing services that meet the expectations of their customers. However, the evidence from this study suggests that many in top management may have not fully understood the meaning of ES adaptability and as a result did not accurately assess the current state of their implemented ES. Therefore, they perceived their current ESs as adaptable in essence, when, in fact, they were less adaptable in practice. The study findings, limitations, and possible future research are discussed.

INDEX TERMS Adaptability, enterprise system, enterprise system adaptability, top management, satisfaction, empirical study.

I. INTRODUCTION

Organisations are increasingly turning to Enterprise systems (ESs) to run their business, achieve their goals, and remain competitive [1]. An effective ES should allow organisations to model their business processes into a consistent set of tasks and data that delivers value-added results to customers all the time [2]. However, ESs operate in environments that change frequently and, as a result, they need to be adapted quickly and cost-effectively [3]. Failure to effectively align new business requirements with the ES can result in a severe failure of the system and a loss of competitiveness to the business [4]–[6]. In addition to this challenge, the implementation of ESs has remained far from smooth and usually exceeds agreed budgets, even under ideal circumstances [2], [7]–[9].

These are concerns worth facing, as studies have shown that successful implementation of an ES can deliver many benefits to large, medium, and small organisations [10]–[17]. Among these benefits are reductions in total costs, reductions in operation time, improved information transactions, refined business process integration, better management decision-making, enhanced organisational performance, and advanced competitive advantages. A comprehensive list of the possible ES benefits used to assist in the evaluation processes and decision-making of business managers was given by [18] and [19].

Considering the expense and risk associated with implementing an ES [2], it is only fair for organisations with long-term goals and strategies to expect to receive a long-term return on their investment in the ES. This is particularly relevant in an environment in which the high failure rates of ES projects raises questions about the actual financial and business payoffs of such investment [20]. The implementation of an ES that only meets initial requirements set out at a single point in time is not a sustainable solution [18]. In most cases, any changes required after the initial implementation

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of the ES add to the initial cost of the ES project, which is already high in itself [21]. Therefore, an ES to be delivered to a given business must be designed not only to meet certain static organisational requirements or market needs, but also to provide continuous support to meet changing requirements throughout the entire life cycle of the ES [22].

As a result, ES adaptability is emerging as a key to the success of the system in the dynamic business world [23]. Whether a change to an ES is planned years in advance or just decided as a result of new circumstances, effective adaptable ESs need to be designed to respond and allow changes to happen easily, rapidly and cost effectively [24]. Adaptability can increase the lifetime value of an ES and save organisations the cost of a complete replacement when they need to make significant organisational changes [25].

Given the significant role top management plays in fostering ES implementation [26]–[28], it is important that the top management perspectives, objectives, and concerns of ES adaptability are addressed. For the purpose of this study, 'top management' is considered to include CIOs, CEOs, business owners, and IT managers and directors. Individuals at these levels are expected to be in positions of power in their respective organisations and to be actively involved in the decision-making regarding changes to the ESs of their respective organisations.

However, to the best of our knowledge, no previous studies have been conducted to survey the satisfaction of top management with current ES adaptability. In this study, we attempt to close this gap by assessing the satisfaction of top management with the current state of ES adaptability in their organisations and identifying their concerns. In addition, we seek to address inconsistencies in the literature review in the definitions of the concepts of ES and ES adaptability which have led to contradictory findings. This paper will attempt to provide clear and comprehensive definitions for both concepts to resolve any contradictions.

The paper is structured as follows. Sections II, III, and IV define the main conceptual definitions and explore related work. Section V describes the empirical research methodology we used to investigate the research scope. In Sections VI and VII, we analyse and discuss the insights we gained. Section VIII gives some recommendations for top management to consider when dealing with ESs. Section IX offers our final conclusion and presents the implications of the study and suggestions for future research.

II. THE CONCEPT OF ENTERPRISE SYSTEM (ES)

The enterprise system (ES), also referred to as an enterprise information system (EIS) and enterprise resource planning system (ERP system), has become a critical component of the success of modern organisations since the inception of this type of resource planning [8], [11], [29]. Although the term 'ERP system' has become the preferred and accepted term for enterprise systems in the industry since its introduction by Gartner in the 90s [30], the term 'ES' addresses the nature of these systems more adequately [21], [31].

An ES can come in any form, size, and functionality, based on the demand. An ES can be purchased off the shelf (COTS) from systems vendors such as SAP [32], Oracle [33], IBM [34], and Microsoft [35], or it can be a bespoke, custom-built system (CBS) to support the specific needs of an organisation [36], [37]. Each option offers its own advantages and disadvantages [38], [39]. Industries in specific sectors with specific needs and tasks usually prefer to develop CBSs [31], because their unique processing requirements cannot be met by general-purpose COTS systems. Regardless of the system type, it has been demonstrated that financial markets consistently reward ES adopters with higher market valuations than non-adopters [40], [41].

Many studies have investigated the critical success factors (CSFs) for ES implementation [1], [42]–[44]. CSFs that appear most frequently across these studies include top management support and commitment, quality business process re-engineering, sound change management, competent project teams, effective communication, well-implemented user training and education, well-facilitated orientation to new business processes, active project management, and proactive vendor support [17], [45]–[47]. A successful implementation of an ES can be deemed to have been achieved when the organisation is able to perform its business and meet its targets, post-implementation, better than it did before the ES was in place [48].

The development of the ES has evolved through several phases over many decades. This development has been driven by significant changes in business requirements, technological advances, and the need to provide viable alternatives to traditional legacy IT systems [49], [50]. An in-depth history of ESs can be found in [31], [51]–[54]. Today, ESs are even more advanced and complex, as a result of the increasing development of technologies available through the Internet. The developers of future ESs are focused on delivering systems that are sensing, smart, adaptable, and sustainable [55].

A. DEFINITION OF ES

Due to the dynamic nature of ESs, there is no single accepted definition of enterprise system in the literature. Although there are common characteristics that appear frequently in ES definitions, such as 'integration' and 'centralisation', it is important to develop a broader definition of ES in order to represent the current systems more adequately.

The American Production and Inventory Control Society (APICS) definition of ES, as 'an accounting-oriented information system for identifying and planning the enterprise-wide resources needed to take, make, ship, and account for customer orders' [52], is one of the most popularly-held definitions of these systems. APICS similarly described an ERP as 'a method for the effective planning and controlling of all the resources needed to take, make, ship, and account for customer orders in a manufacturing, distribution, or service company' [52]. Another popular definition of the ES as an 'ERP system' was presented by [8], who explained: 'as commercial software packages, ERP systems provide

cross-organisation integration through embedded business processes, generally comprising several modules, including logistics, procurement, sales, marketing, human resources, and finance'. Brown and Vessey [56] considered the ES as 'a large-scale, cross-functionally integrated, packaged system'. Rashid *et al.* [50] defined ESs as 'software systems for business management, encompassing modules supporting organisational functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resources management, project management, inventory management, service and maintenance, transportation, and e-business'. Gartner Group defined the ES as 'a business strategy and a set of industry-domain-specific applications that build customer and shareholder value by enabling and optimising enterprise and interenterprise, collaborative-operational and financial processes' [30].

Taking into consideration these definitions and the ways that ESs have developed, we formulated the following definition, which takes into account, in a comprehensive manner, the essence of contemporary enterprise systems. For this study, an ES is defined as:

Any software system that executes an organisation's business processes through the use of data and technology to achieve certain goals and enhance the competitive advantage of the organisation.

Building on this definition, ESs are understood to be socio-technical systems that involve people, software, hardware, processes, and data; this understanding is in line with that presented in other studies, such as [51]. The objective of the ES, in this context, is to more efficiently and effectively conduct business processes and information flow [57].

III. THE CONCEPT OF ENTERPRISE SYSTEM ADAPTABILITY

Recognition of the need for adaptable IT solutions to operate effectively in the dynamic business environment has led to a growing interest among researchers and practitioners to highlight the importance of ES adaptability and to support the development of more adaptable ESs using emerging technologies [3], [23], [25], [58], [59].

Through a survey of the literature, we were able to observe a number of patterns that exist specific to ES adaptability. The identified patterns fall into two groups: 1) studies of mechanisms designed to achieve ES adaptability, such as [60]–[62]; 2) studies evaluating the adaptability of systems, such as [63]–[66]. However, to avoid any misunderstanding, before we can consider 'adaptability', it is important to clearly distinguish the following key terms. First, 'an adaptable ES' is not the same as 'a self-adaptive ES'. An adaptable ES can be adapted by someone externally, while a self-adaptive system is able to adapt by itself [67]. This is explored further in the next section. Second, 'the environment of an ES' is not the same as 'the environment of a software system', therefore ES adaptability is different from software system adaptability. ESs are run-time systems and they include the logic of the business, so any changes required would need to be made while the system is running. Changes to software systems, which exist in the development/manufacturing environment, can be made offline. Only two of the studies reviewed made these key distinctions: [64] and [65].

The focus of this study is on adaptability in terms of the ability of an ES to be adapted by developers to address new changes. Therefore, we are interested in 'systems adaptability' not in 'self-adaptive' systems. Many authors have argued that, to make a system adaptable by the user, adaptability must be built in during the design stage and at the architecture level [23], [25], [68], [69]. Others have seen adaptability as one of many key attributes of software quality, such as availability, flexibility, reliability, and robustness [61]. As a result, only the existence, rather than the level or means, of adaptability, is fully considered in such studies. Clearly, the way we define adaptability determines what can be learned about ES systems as well as the pathways for their development.

A. DEFINITION OF ES ADAPTABILITY

The term 'adaptability' is often linked to the ability to deal with uncertainty. However, because there is no single concrete definition of the term in the software systems literature [63], researchers have offered conflicting interpretations of ES adaptability. Table 1 captures the inconsistency of the definitions of adaptability in the literature by listing some examples.

TABLE 1. List of definitions of adaptability.

Definition	Source
The ability of a system to be changed to fit diverse circumstances.	[25]
The degree to which adjustments in practices, processes, or structures of systems are possible to projected or actual changes of its environmental.	[70]
The ability to change or to be changed in order to fit transformed circumstances.	[71]
The ease with which a system or parts of the system may be adapted to the changing requirements.	[72]

According to [67], the definition of the term 'adapt' can be used both in the transitive and the intransitive form. If used in the transitive form, 'adapting a system' refers to a system being changed by an outside party (adaptability). Therefore, a system that is 'adaptable' can be changed by an outside party. This definition of adaptability has been adopted by some researchers, including [68] and [73]. On the other hand, in the intransitive form, 'a system that adapts' describes a system's ability to adjust itself to changing environments. In this case, a system that is 'adaptive' (or self-adaptive), can self-identify the need to change and can self-respond with suitable alternatives, with no external input. This definition of adaptability has been considered by multiple academicians and practitioners such as [2], [61], [62], [74]–[77]. As defined by [60], a system is 'adaptable' if it can be altered by someone, while it is 'adaptive' if it can sense the need and generate the alteration by itself. It is noteworthy that there is more literature on self-adaptive systems than on system adaptability.

Although the word 'adaptability' can be interpreted in many ways, the core assumption is that something that is 'adaptable' is 'changeable'. From a systems-engineering perspective, as a non-functional property of the system design, 'adaptability' can be seen as 'the degree to which a product or system can effectively and efficiently be adapted for different or evolving hardware, software, or other operational or usage environments' [78]. ES adaptability can then be understood as the ability of the system to be adapted to accommodate changes in the user requirements or environment. The environment can include internal influences, such as organisational goals, strategy, and business processes, or external conditions, such as government regulations and policies [79]. While internal changes can be controlled by organisational management, external changes, such as the current COVID-19 pandemic, are beyond the control of the organisation [79]. The uncertainty created by both internal and external changes in the business environment necessitates ES adaptability.

Thus, an adaptable ES is a system that has the capability to allow adjustments to be made to its structure and behaviour to meet the needs of its new environment, resulting in a new state of the system. If an ES is adaptable, an organisation can adapt the same ES to different settings as required by altered business processes, and it can provide different services throughout the life cycle of the system [22]. An ES that is not designed to provide such support over its lifetime is said to be 'non-adaptable'. We can formulate this as:

A system S faces a change event E in its environment; S is adaptable if its behaviour can be adjusted to fit E, resulting in (S → S), where S* is the new running state of S.*

The aim of ES adaptability in this context is for the system to be reoriented to provide additional or alternative services in a relatively short time with less effort and at a low cost. ES adaptability should enable an organisation to respond to uncertainties caused by changes in the environment by ensuring the ES can deal with both new requirements not present at ES design-time and requirements that change during ES run-time. Organisations with high ES adaptability are expected to be able to adapt to changes in internal and external environments in a way that is sustainable.

IV. RELATED WORK

Most professionals working in top management recognise the importance of investing in ESs to enable them to run their businesses efficiently and to maintain competitive advantages over other organisations [41]. It is less clear whether these managers consider the potential adaptability of the ES they choose to implement. Several studies have made a case for designing systems for adaptability [23], [25], [58], [59]. Kasarda *et al.* [80], for example, called for the adoption of a new methodology, 'design for adaptability' (DFAD), to influence the development of sustainable technology. Such technology would be able to respond to emerging performance requirements as they arise from external shifts in economy, environment, culture, and other influencing factors. Similarly, Kissel *et al.* [59], advocating for the implementation of DFAD, proposed a technique for enhancing the adaptability of a system in a systematic way. Fayad *et al.* [81] recommended the development of more adaptable and scalable architectures that can accommodate the evolving nature of technological development and reduce costs associated with software development. Zhu *et al.* [58] argued that good system design must be adaptable, and offered a design method that takes adaptability into account.

According to Caetano *et al.* [82], a key challenge facing those who seek to design adaptable software solutions is the lack of models or design processes that are explicitly linked to the business domain; the absence of this connection makes it difficult to identify and support business needs. Andresen and Gronau [61] blamed the difficulty of developing adaptable systems on a software development process that lacks systematic techniques. Brown [83] found that designing an adaptable ES requires an architectural software strategy that enables architects to expand their solutions in a flexible manner and to build upon previous efforts in the context of new capabilities that can improve operational speed and efficiency.

Several techniques to achieve ES adaptability have been proposed in a range of contexts, including model-driven architecture, reflective architecture, and service-oriented architecture [84]. An example of this is the novel conceptual independence approach employed by Tarenskeen [85], which could be used to develop adaptable information systems based on model-driven architecture. Conceptual independence improves adaptability by isolating business domains from functions [86]. A number of other techniques also offer the potential to increase ES adaptability. Chen *et al.* [87] found that service-oriented systems such as cloud ESs and web-based ESs can be more easily adapted to address changing business demands. Such systems are also less expensive, especially for small and medium-sized businesses, and can provide innovative customer service [88]. Acknowledging the significant advancements being made in machine learning techniques, Vom Brocke *et al.* [89] argued that ESs will become intelligent and highly adaptable in the coming years as more applications are enabled by artificial intelligence.

According to Rajgopal *et al.* [90], the successful implementation of an ES requires proper planning and management in all respects because it typically involves technological innovation and organisational change management [91]. Many other studies have shown that top management plays a significant role in assuring the success of an ES over its life cycle [92]–[94]. Somers and Nelson [95], in particular, argued that actions performed by top management, such as choosing the ES, setting clear goals and objectives, committing to finance the system, and managing changes, are critical. If top management delegates responsibilities associated with the ES to technical experts on a permanent basis, the likelihood of project failure is high [96]. Effective IT management by those who control the organisation at the highest level is necessary to ensure that the ES of the organisation is in

compliance with the overall goals and requirements of the business [97].

Not only has top management support been identified as a critical success factor in ES implementation [45], [98]–[100], but it was, in fact, ranked *first* among 31 critical success factors identified in a study conducted by [101]. This study further suggested that the issues most likely to cause ES failure are related to managerial approach to the ES, with a lack of commitment and the inability to set a purposeful strategy identified as two approaches that result in setbacks. Multiple studies have shown that project managers involved in a process that is being changed may resist or delay the changes, being wary of the unknown risks, costs and drawbacks associated with them [102], [103]. A study conducted by [104] examined the impacts of senior leadership on IT assimilation and found that the business and IT knowledge of CIOs can significantly influence this process. Therefore, sustained support and commitment from management are needed not only during the selection process and investment in an ES but also at all stages of the ES implementation [105], [106]. Best outcomes will be achieved when top managers continually monitor the ES as it runs and respond to changes effectively as they appear.

Despite the critical role top managers play in the successful selection and implementation of an ES, very little is known about their understanding of and attitudes toward ES adaptability. The study presented in this paper expands on previous research conducted to investigate how top managers address ES adaptability. While previous research focused on achieving ES adaptability, this study focuses on the influence adaptability has on the satisfaction of top managers with their systems.

V. RESEARCH METHODOLOGY

A. STUDY SAMPLE

We primarily focused on reaching top managers and executives for our study. To obtain a representative sample, we identified 200 executives on LinkedIn as potential participants, based on available profile information. Fig. 1 displays the selection criteria and processes. We then invited 140 eligible participants from the list of executives to participate in the study. They were asked to complete a survey by responding to a series of questions about their personal and business experiences with ESs. Several rounds of follow-up reminders were sent in an attempt to increase the sample size. Ultimately, only 80 executives initiated responses to the survey, resulting in an initial response rate of 57.14%. Of the 80 participants who started to answer the survey, a total of 70 participants completed it in full. Both partially completed and fully completed responses are considered in the analysis. No incentive was given to participants to complete the survey.

B. STUDY DESIGN AND MEASUREMENTS

After a careful review of the existing literature, we identified a list of factors (see Table 2) that can be used to assess the satisfaction of top management with the current adaptability

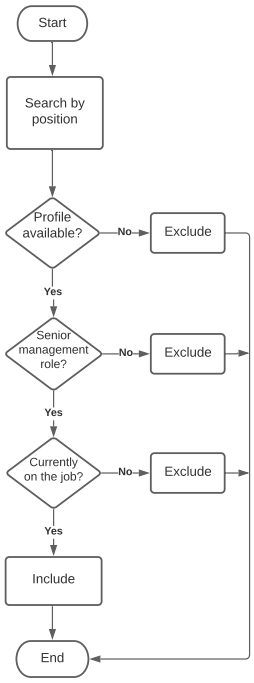

FIGURE 1. Selection flowchart for potential participants.

of their ES, as reflected in their evaluation of these factors with respect to their ES. However, we slightly modified the measurements to suit our study objectives more adequately. These measures have been adopted from the literature, with reference to studies including [64], [65], [107]–[109]. In total, the questionnaire contained 26 questions designed to assess participants' opinions on various aspects of ES adaptability, based on their experience. Nineteen questions were multiple choice and seven were Likert-scale questions. The Likert-scale questions were answered on a five-point scale, with the addition of a 'Not applicable' option, to increase the level of data integrity. The response categories were: 0) Not applicable, 1) Strongly disagree, 2) Disagree, 3) Neutral, 4) Agree, and 5) Strongly agree.

We designed the online survey based on the guidelines defined by [110]. As suggested by [110], the first draft of the questionnaire was given to two independent experts in the field for review to ensure the validity and reliability of the proposed scale. The experts were asked to evaluate the content and structure of the questionnaire based on their knowledge and expertise. They evaluated the scales, clarity of expression, probable level of difficulty, question order and reliability, among other aspects of the survey. After several rounds of revision and modification, taking into account all the suggested improvements, a final draft of the questionnaire was approved by the experts. The final questionnaire included the following features:

1) a brief description of the study's purpose, aims and target;
2) a clear explanation of the key terms and definitions;

TABLE 2. List of measures of ES adaptability.

Factor	Description	Source
Cost	Cost required to adapt the ES	[64], [65], [107]
Time	Time required to adapt the ES	[64], [65], [107]
Complexity	Complexity of the process involved in adapting the ES	[64], [65]
Risk	Risk of failure following adaptation	[64], [65]
Difficulty	Level of difficulty encountered during the adaptation	[64]
Disruption	Amount of disruption caused during the adaptation that affected the availability of the ES	[64], [65]
Staff satisfaction	Level of staff satisfaction with the adaptation	[108], [109]
Customer satisfaction	Level of customer satisfaction with the adaptation	[108], [109]
Competitiveness	Impact on organisation's competitive advantage following adaptation	[108], [109]

3) questions divided into sections based on purpose;
4) questions written in clear, unambiguous, and understandable language;
5) a format that was reasonably short, and easy to follow and fill.

C. DELIMITATIONS OF THE STUDY

The study is limited to the satisfaction of top management with current ESs adaptability. Therefore, for the purpose of the analysis, we excluded other participants, such as IT consultants, and we also excluded unrelated questions, such as questions about future ESs. In addition, the survey questions were restricted to closed-ended Likert-scale and multiple choice types in order to encourage participants to take part in and complete the survey.

D. LIMITATIONS OF THE STUDY

One of the limitations of this study is the sample size involved. A larger sample size would give more accurate results. We believe that several factors contributed to the low response rate. First, the study was conducted during the COVID-19 pandemic and we fear that this may have had a negative impact on the response rate. The target audience may have been unavailable to participate due to illness or lockdown restrictions affecting their workloads and ability to work outside the demands of their immediate operations. Moreover, some participants may have felt that it was inappropriate to participate in a study in the current climate. A study completed by Qualtrics [111] shows that almost two in three organisations cancelled or postponed some of their own planned research in light of the COVID-19 pandemic.

A second limitation was the fact that not every member of the target audience who began the survey completed it. Top managers are known to be, typically, very busy and overloaded with work, due to their work duties and responsibilities. It was hard to reach out to them and even encourage them to take part in the first place. Despite all the difficulties and the challenges that we faced, the sample size of our survey was sufficiently large to gauge the median sentiment of the target population.

The fact that the study relied heavily on the opinion of decision-makers, in particular, the top management, was a third limitation. There may be other important aspects in addition to the opinions of decision-makers that have a significant impact on the way ES adaptability is understood and valued.

E. DATA COLLECTION

The data for this study were collected through a secure web-based questionnaire accessible between August and November 2020. Participants that completed the questionnaire came from New Zealand, Saudi Arabia, the United Arab Emirates, Oman, Egypt, Kuwait, Jordan, India, and Sudan. In order to reduce social pressure and social desirability biases, we made it clear that we would not record identifying details. Participants were informed that no identifiers would be recorded and the data would be kept confidential. The purpose of the study was clearly presented to the participants when they were invited to complete the questionnaire and again in the introduction to the questionnaire. Important terms related to the study, such as the definitions of ES and ES adaptability, were clearly identified and included in the questionnaire. The study protocol was approved by the local ethics committee.[1]

As can be seen from Table 3, almost all of the respondents indicated that they hold a senior position in their organisation, serving as IT managers, IT directors, CEOs, and CIOs. We also had a reasonable number of IT consultants among the participants. A few participants held lower positions; these included a head of HR, a data scientist, an operational general manager, and a chief digital architect. These respondents were grouped into the 'other' category. It is worth noting that we had not been able to detect these 'other' positions when we were identifying and inviting study participants, and we suspect that some of the selected participants had moved into other positions without updating their profiles. For the purpose of this study, we only focus on participants in top management roles. Table 3 shows that, out of the 80 participants, 28% were IT managers, 19% IT directors, 11% CEOs, 10% CIOs, and a much smaller percentage were project managers, system managers, and business owners (6%, 3%, and 3%, respectively). Eight per cent of the respondents worked in roles considered 'other', for the purposes of this study.

The average number of years that the respondents had worked for their respective organisations was ten, and

[1]The University of Auckland Human Participants Ethics Committee. Reference Number 023526.

TABLE 3. Position of respondents in their organisations (N = 80).

Position	Frequency	Percentage
IT manager	22	28%
IT director	15	19%
IT consultant	11	14%
CEO	9	11%
CIO	8	10%
Project manager	5	6%
System manager	2	3%
Business owner	2	3%
Other	6	8%
Total	80	100%

respondents had worked an average of ten years with the ES system in their organisation. Fig. 2 details the roles the participants played in terms of selecting and adapting their ESs. The majority of respondents (81%) were involved in the selection of their current ES; nineteen per cent were not involved in the selection process. A possible reason for this lack of involvement is that these staff members had joined the organisation after the implementation of the ES. The same percentage of respondents (81%) signalled that they were in a role that meant they would likely be consulted during a decision to change an ES. All of the participants were in a role that meant they would be involved in the technical component of changing an ES.

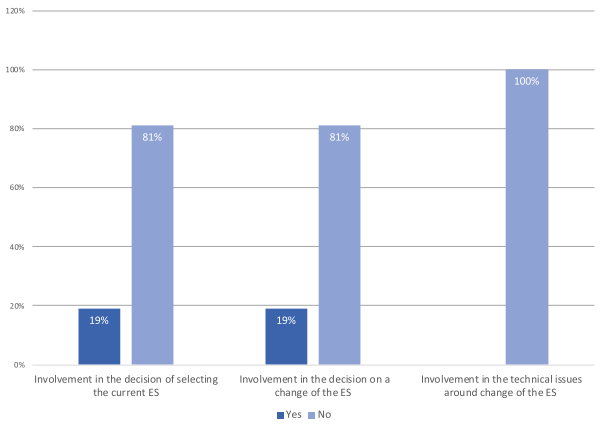

FIGURE 2. Participant's involvement in decisions.

Table 4 reveals demographic information of the organisations represented by the respondents, including size, scope of business, and sector. In order to determine the size categories, we adopted the European definition [112] that considers a 'small-sized organisation' as one having less than 50 employees, a 'medium-sized organisation' as one with between 50 and 249 employees, and a 'large organisation' as one with more than 249 employees.

The pie chart in Fig. 3 captures the various organisational fields that are represented in this survey, including telecom/IT (19%), industry (16%), education (12%), and oil/gas/energy (9%), among others.

TABLE 4. Demographic information of the sample organisations.

Organisation characteristics	Categories	Percentage
Size	Small	19%
	Medium	16%
	Large	66%
Scope	International	40%
	National	33%
	Regional	16%
	Local	12%
Sector	Government	22%
	Semi-government	28%
	Private	50%

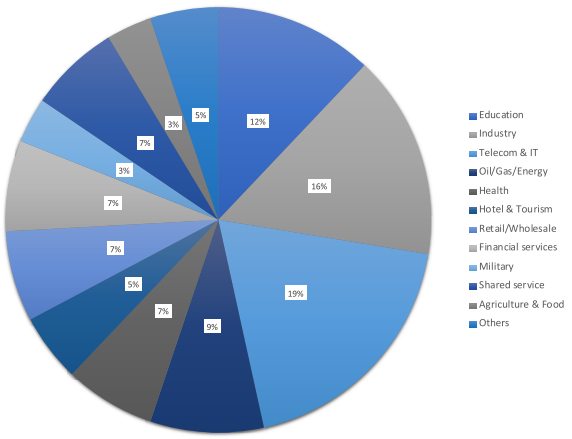

FIGURE 3. Organisational fields of respondents.

VI. DATA ANALYSIS

To assess the data, we measured their reliability, validity, and any possible bias using SPSS. These measurement techniques are widely accepted for the analysis of survey data.

A. TESTING OF CONSTRUCT RELIABILITY

This study included single constructs and composed constructs. The Cronbach's alpha coefficients of the composed constructs were greater than 0.70, giving an acceptable level of reliability [113]. Table 7 displays a list of the composed constructs along with their determined reliability.

B. TESTING OF COMMON METHOD BIAS

Since the survey data were collected from one sample, through the same questionnaire, during the same period of time, Common Method Bias (CMB) may have occurred [114], [115]. To detect CMB, we applied Harman's single factor test. The exploratory factor analysis results showed that a single factor did not account for the majority of variance (22.871%), which suggests that CMB was not a significant issue in this study.

C. TESTING OF NON-RESPONSE BIAS

In addition, non-response bias created by refusals to participate may have had a negative impact on our study. A small number of invited individuals regarded the invitation to participate with suspicion. They had concerns about the security and confidentiality of the online survey, and these concerns discouraged them from participating. One major effect of non-response is that it did reduce the sample size. To further investigate the impact of this on the study, we tested for non-response bias using the guidelines given by [116]. Respondents were grouped as 'early' and 'late' respondents. When key measures of the first and final 25% of the respondents were compared, no significant differences between early and late respondents were observed. This indicates that non-response bias was not significant in this study.

VII. RESULTS AND DISCUSSION

The results of the distributed questionnaire are fully interpreted, analysed, and discussed in this section. For analysis purposes, the Likert-scale answers are categorised into three groups: 1) Agreement (strongly agree and agree), 2) Neutral, and 3) Disagreement (strongly disagree and disagree).

A. OVERVIEW OF THE IMPLEMENTED ES

Table 5 displays an overview of the ESs implemented by the respondents' organisations. Systems developed by Oracle, SAP, and Microsoft (40%, 21%, and 12%, respectively) were the most implemented. This was not a surprise, since these large vendors are considered to be the top ES vendors in the market [117]. The results in Table 5 indicated that more than half of the organisations (53%) had to replace their ESs at least one time, with 33% having made one replacement and 26% having required more than one replacement. Interestingly, a small number of organisations (5%) were still running legacy systems that had been implemented between 1998 and 2000, while 19% were using systems implemented between 2001 and 2010. It is worth noting that two systems in particular, one implemented in 1999 and the other implemented in 2001, were reported by two respondents to be 'not adaptable'.

According to the report from the Panorama Consulting Group 2020 survey [117], many organisations are finding they have no choice but to replace their legacy systems and to implement modern systems in order to keep pace with their competitors. This was likely the case for the majority of respondents (71%), who reported that their organisations had shifted away from legacy systems and implemented more recent ESs, most of which had been implemented between 2017 and 2019.

Adopting an ES requires a significant investment from the organisation, and these costs must be carefully managed. Considering the fact that the history of ES implementation is full of tales of dramatic failures due to cost-related issues [20], [118], it is interesting to note in Table 5 that around half of the respondents stated that their current ESs had been implemented within the projected budget and approximately 33% of the organisations had experienced budget overruns (24% had somewhat exceeded the budget, 9% had significantly exceeded the budget). These findings are in line with the results of the Panorama survey [117]. More than half (62%) of the participating organisations in that 2020 survey reported having completed their ES projects at or under budget, an increase of 7% who had done the same over the previous year [117].

TABLE 5. Overview of implemented systems by organisations.

Character	Option	Percentage
System type	Oracle	40%
	SAP	21%
	Microsoft	12%
	Odoo	3%
	Custom by third party	5%
	In-house	9%
	Mix of systems	5%
	Other	5%
Year of implementation	1998–2000	5%
	2001–2010	19%
	2011–2020	71%
	Don't know	5%
Replaced an earlier system	Yes	53%
	No	31%
	Don't know	16%
Number of replacements of earlier systems	0	41%
	1	33%
	2	19%
	≥ 3	7%
ES budget	Within the budget	53%
	Somewhat exceeded	24%
	Significantly exceeded	9%
	Don't know	14%

To further examine why the respondents of this study selected a particular ES, we can refer to Table 6, which reveals that the most common reason was that the chosen ES was the 'best match for our business processes'. This is consistent with studies that have demonstrated the importance of aligning a company's business processes with its ES to prevent a severe failure of the system and a loss of competitiveness [4], [17]. Working with an ES that does not align with an organisation's business processes is noted to cause employee frustration and other organisational issues [117].

Respondents were asked at what point they thought it would be best to consider the adaptability of their ES: before, during, or after implementation. Fig. 4 presents the participants' opinions on this matter. Results show that over half of the respondents would agree with researchers who assert that systems need to be designed with adaptability in mind from the beginning to be truly adaptable [73], [80]. Twenty-five per cent indicated that it would be best to consider adaptability

TABLE 6. Reasons for selecting the current ES.

Reason	Frequency	Percentage
Best match for our business processes	41	71%
Value for money	3	5%
Popularity	2	3%
Existing relationship with vendor	1	2%
I don't know	7	12%
Other	4	7%
Total	58	100%

during implementation, and 18% afterwards. However, considering adaptability after the 'go-live' of the ES is arguably not good practice. This is because it is too risky to modify a system's structure after it has passed the design and development phase and exited the development environment [119]. Although most of the ES vendors allow a fair amount of customisation and configuration of the systems, significant post-implementation reconfigurations or new add-on functionalities to meet new requirements may not always be supported [28]. Some vendors even discourage modification or customisation of a system after implementation, as the redevelopment required each time a new system upgrade or patch is installed can render upgrades very costly, if not impractical [21], [120].

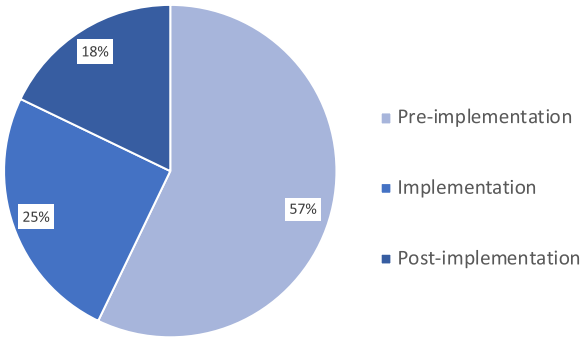

FIGURE 4. When ES adaptability should be considered.

B. TOP MANAGEMENT PERCEPTION AND SATISFACTION WITH ES ADAPTABILITY

The study findings presented in Table 7 show that most of the top-management respondents (91%) were in general agreement that adaptability is important for an ES to have. This indicates a high awareness among management of the importance of ES adaptability. This awareness was also reflected in the percentage of respondents (79%) who had considered adaptability to be a major requirement in the acquisitions of their organisation's current ES.

Because most of the top managers involved in this study recognised the importance of ES adaptability and showed a great interest in it, we would expect them to be currently working with ESs that are, in some way, adaptable. Indeed, the majority of them (70%) did consider their current ESs to be adaptable systems, which then begged the question of whether these ESs were, in fact, adaptable enough, and whether they were satisfied with the level of adaptability of these ESs. To find out, we asked the participants to evaluate their currently implemented ESs against the outlined measurable factors derived from our analysis of the literature.

Table 7 displays the details of participants' attitudes towards the adaptability of their current ESs (CS1-CS9), while Table 8 presents the correlations between them. Obviously, some factors were more revealing, in terms of inferring levels of satisfaction, than others. The findings show that the greatest number of participants perceived ES adaptation as time consuming and costly (48% and 46%, respectively). Sommerville [107] found that changes to be made to non-adaptable systems after development are time consuming and add to the cost of system development because so much of the work has to be redone. Therefore, we would argue that a truly adaptable ES should allow changes to be made in a relatively short time and at a reasonable cost, and, as a result, that the ESs of these respondents were not particularly adaptable.

In addition, the adaptation process was also reported by some top management to be complex and difficult, and to involve some level of risk and disruption (Table 7). For some organisations, the adaptation caused some major dissatisfaction to staff members and even to the clients of the organisations. A few top-management respondents (16%) also admitted that their competitive advantages had been negatively affected when they were in the process of adapting their ESs. These disruptions to businesses and users might be due to possible system outages caused by both large changes and slight modifications. These findings are in agreement with the findings in [64], [65], which showed that time, cost, complexity, and risk are critical factors to overcome in the development of ES adaptability.

Overall, it is clear from the responses from top management that they had experienced disruptions as a result of the adaptation of their previous ESs; however, we were happy to see that some of the organisations reported having managed to handle the adaptation quite well. It is also worth noting that there was a sizable group of participants, ranging from 20% to 39%, who offered no opinion on the evaluation of the adaptability of their current ES, Table 7. A possible explanation for this might be that this group of participants had not had to adapt their systems before and therefore had no previous experience to evaluate and share.

More interestingly, although the majority of the participants confirmed that their current ESs are adaptable, 91% of them still believed that organisations should give ES adaptability more attention (57% strongly agreed, 34% agreed). These two opinions have a significant correlation at the 0.01 level ($r = 0.533$). This is somewhat surprising: if the current ESs are adaptable, why would the adaptability of such systems require more attention and support? Also, if the current ESs are adaptable, then why do they cost considerable money and time to be adapted?

TABLE 7. Constructs along with their questionnaire items.

Construct	Item	Agreement	Neutral	Disagreement	Mean	Std.	Cronbach's α
Current ES adaptability							0.881
	CS1: It is complex to adapt our current enterprise system to new changes	38%	20%	43%	3.04	1.095	
	CS2: It is time consuming to adapt our current enterprise system to new changes	48%	34%	18%	3.38	0.983	
	CS3: It is expensive to adapt our current enterprise system to new changes	46%	29%	25%	3.23	1.027	
	CS4: It is risky to adapt our current enterprise system to new changes	29%	30%	41%	2.88	1.010	
	CS5: It is difficult to adapt our current enterprise system to new changes	21%	21%	57%	2.59	1.005	
	CS6: It is disruptive to operations to adapt our current enterprise system	23%	39%	34%	2.80	1.017	
	CS7: Whenever our enterprise system needs to be adapted, it causes major dissatisfaction to our staff	29%	21%	50%	2.75	1.179	
	CS8: Whenever our enterprise system needs to be adapted, it causes major dissatisfaction to our customers	16%	21%	61%	2.41	1.092	
	CS9: Whenever our enterprise system needs to be adapted, it negatively affects our competitiveness	16%	21%	61%	2.39	1.107	
Adaptability of current ES							0.793
	AS1: Our current enterprise system can be considered an adaptable system	74%	19%	3%	3.84	0.988	
	AS2: Adaptability was a major requirement in our current enterprise system acquisition	79%	14%	3%	3.95	1.115	
Importance of ES adaptability	IS1: Adaptability is important for an enterprise system to have	91%	3%	3%	4.33	0.925	
Assessment of ES adaptability	FS1: We would like to use a standard framework to assess our current ES adaptability	71%	21%	7%	3.84	1.005	
Support of ES adaptability	SS1: Organisations should give enterprise system adaptability more attention	91%	7%	2%	4.47	0.706	

This inconsistency in their responses may be due to the beliefs and considerations of top management regarding ES adaptability. We suspect that the inconsistent definitions of ES adaptability in the literature have contributed to this confusion. Despite having been given a specific definition to consider for this study, top management may have based their responses on their own understanding of the meaning of ES adaptability and regarded any system update or upgrade as part of its adaptability, hence they consider their ESs 'adaptable' even if they were not, in fact, adaptable. Alternatively, top management may have considered their ESs to be indeed adaptable if they demonstrated some degree of adaptability, but these systems may, in reality, not be as adaptable as the top management think they are and would want them to be, and this explains why so many reported struggling with features like cost and time and called for more attention to be given to ES adaptability. These results further explain our impression that top management are not, in fact, very satisfied with the level of adaptability of their existing ESs.

It is also interesting to note that a significant number of respondents showed a strong desire to have a standard framework against which to assess the adaptability of their current ESs (71% strongly agree and agree). This indicates that many top managers are not confident in their ability to conduct a professional and accurate evaluation process that would reflect the true state of the adaptability of their ESs.

C. RESPONSIBILITY FOR ADAPTING AN ES

One of the important points to consider when examining ESs is who takes responsibility for adapting the system when this is needed. As represented in Fig. 5, the study results show that this point is quite arguable. While 53% of the top management believed that it is the responsibility of their organisation to adapt the system, 36% of the respondents believed it is the responsibility of the supplier of the system to adapt it after the system has gone live. It is interesting to see how divided respondents were on this question of who is responsible.

To find out how top management usually manage the adaptation of their ESs, we asked them to whom they would give this task. As shown in Table 9, the most common approach was to give the task to internal developers. This approach

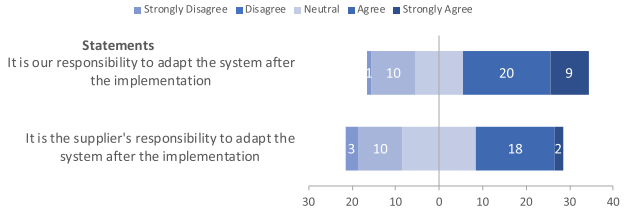

FIGURE 5. Responsibility for adapting ES.

is a particularly good choice for organisations that do not necessarily depend on a third party, such as system vendors, and instead rely primarily on internal developers to run and maintain the functionality of the ES.

The second most common approach was to ask the system's vendor/provider to adapt the system to new settings. This makes sense, because a large number of the representatives of the registered organisations in our study indicated that their current ES had been purchased from a vendor such as Oracle, SAP, and Microsoft. This finding is in agreement with the findings in [121], which showed that organisations become increasingly dependent on their chosen ES vendors and their connections with the vendor as they continue to use the purchased ES system. Organisations that have become dependent in this way would send any change request arising after the implementation of the system back to the vendor to deal with. To a great extent, as some researchers have suggested [122], such dependency on vendors and vendor relationships has become the new normal for businesses that have chosen to purchase their ES solutions COTS. This is further evidenced by findings that the post-implementation service and support provided by an ES vendor have a direct and proportionate impact on that vendor's reputation [123].

VIII. GUIDELINES FOR TOP MANAGEMENT

In light of the major findings of our study, this section makes the following nine recommendations for top management to consider when making choices with respect to their current or future ESs.

1) Implement an up-to-date, bespoke ES. This will better serve the organisation in the long run.

TABLE 8. Correlation of ES adaptability.

	CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9
CS1	–								
CS2	0.477**	–							
CS3	0.445**	0.615**	–						
CS4	0.464**	0.488**	0.537**	–					
CS5	0.542**	0.361**	0.570**	0.611**	–				
CS6	0.284*	0.366**	0.428**	0.648**	0.631**	–			
CS7	0.359**	0.522**	0.454**	0.431**	0.464**	0.383**	–		
CS8	0.337*	0.277*	0.270*	0.361**	0.322*	0.303*	0.604**	–	
CS9	0.543**	0.297*	0.398**	0.305*	0.573**	0.474**	0.592**	0.571**	–

Note. *p < .05, **p < .01, ***p < .001

TABLE 9. Who is assigned to adapt the ES?

Party	Frequency	Percentage
Internal developers	22	39%
The vendor of the system	19	34%
External developers	5	9%
Both/either internal and external developers	3	5%
Internal/external developers and vendor	4	7%
I don't know	3	5%
Total	56	100%

2) Strictly control the budget to avoid cost overruns.
3) Evaluate ES options to choose the best possible match for the business. The ideal ES will align well with the organisation's business processes.
4) Monitor the design of the chosen ES. It should be designed conceptually, with adaptability built-in.
5) Work with the developers and key staff to develop a clear, shared understanding of what it means for the ES to be adaptable.
6) Set the expectation that the adaptable ES will allow changes to be made in a relatively short time and at a reasonable cost.
7) Ensure that the ES supplier, whether internal or external, is capable and willing to adapt the system, as appropriate, to new organisational needs.
8) Be actively involved in and monitor any ES adaptation process.
9) Identify reliable standardised methods for evaluating the adaptability of the ES.

IX. CONCLUSION

A. IMPLICATIONS FOR RESEARCH

The analysis in this study provides several key theoretical contributions to the existing literature. First, to the best of our knowledge, this is the first empirical study that explicitly investigates the perceived importance of and challenges associated with ES adaptability from the point of view of top management. In addition, far too little attention has been paid in the literature to the development of a broader definition of an ES in order to represent the current systems more adequately. We offer a comprehensive and practical definition of the ES.

In addition, this study contributes to the existing knowledge by providing a more intuitive definition of ES adaptability in order to overcome the uncertainty that still exists about the term 'adaptability' as it applies to an ES. These findings should make an important contribution to the field of ES research in general and ES adaptability in particular.

B. IMPLICATIONS FOR MANAGEMENT

The results of this study provide some meaningful implications for management teams. Top management showed a strong interest in ES adaptability, an awareness of the importance of ES adaptability, and a desire for an evaluation framework that can measure the level of adaptability of a given ES. However, the evidence from this study suggests that many in top management may have not fully understood the meaning of ES adaptability and as a result did not accurately assess the current state of their implemented ESs. Therefore, they perceived their current ESs to be adaptable in essence, when they were, in fact, less adaptable in practice. This was clearly reflected when, for example, more managers characterised their experience of the process of ES adaptation as time consuming, costly, and complex, despite having systems they described as adaptable.

Therefore, top management needs to develop a good understanding of ES adaptability in order to more accurately assess the level of adaptability of their current ES and support better decision-making with respect to their future acquisitions of ES. Failure to effectively understand what ES adaptability means may result in the selection of an ES that is not adequately adaptable. This study provides the readers with a better understanding of the meaning of ES adaptability and potential factors against which to measure this.

C. FUTURE WORK

Future research is likely to build upon and extend the results obtained from this study. In order to develop a more accurate understanding of the features and processes which make an ES adaptable, future studies on the topic are recommended. Future work would ideally involve the design and development of a standard evaluation framework to assess the level of adaptability of an ES and give more accurate results.

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